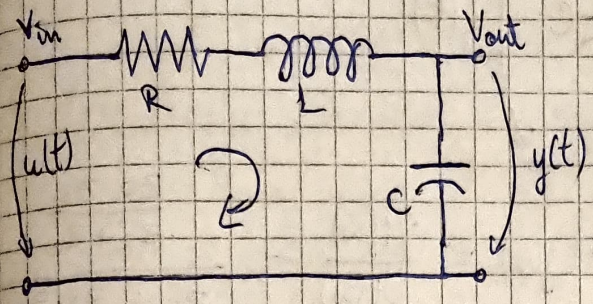
Tema - Lab 3

Conexiune Serie

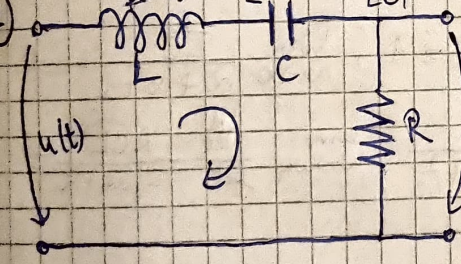
① 

$$H(j\omega) = \frac{Y(j\omega)}{U(j\omega)} = \frac{Z_C}{Z_R + Z_L + Z_C} = \frac{\frac{1}{j\omega C}}{R + j\omega L + \frac{1}{j\omega C}} \overset{j\omega \to s}{=\!=} \frac{\frac{1}{sC}}{R + sL + \frac{1}{sC}} =$$

$$= \frac{1}{RSC + s^2LC + 1} \quad \Big| : LC$$

$$\Rightarrow H(s) = \frac{\frac{1}{LC}}{s^2 + \frac{R}{L}s + \frac{1}{LC}} \; ; \; \lim_{\omega \to 0} \frac{\frac{1}{LC}}{0 + 0 + \frac{1}{LC}} = 1 \; ; \; \lim_{\omega \to \infty} \frac{\frac{1}{LC}}{\infty + \infty + \frac{1}{LC}} = 0 ;$$

$$\lim_{\omega \to \omega_{rez}} \frac{\frac{1}{LC}}{\left| (j\omega_{rez})^2 + \frac{R}{L} j\omega_{rez} + \frac{1}{LC} \right|} = \lim_{\omega \to \omega_{rez}} \frac{1}{LC} \cdot \frac{LC}{RCj\omega_{rez} + 1} = \frac{1}{RCj\omega_{rez} + 1}$$

② 

$$H(j\omega) = \frac{Y(j\omega)}{U(j\omega)} = \frac{Z_R}{Z_L + Z_C + Z_R} = \frac{R}{R + j\omega L + \frac{1}{j\omega C}} \overset{j\omega \to s}{=\!=} \frac{R}{R + sL + \frac{1}{sC}}$$

$$\cdot LC$$

$$= \frac{sRC}{sRC + s^2LC + 1} = \frac{\frac{R}{L}s}{s^2 + \frac{R}{L}s + \frac{1}{LC}}$$

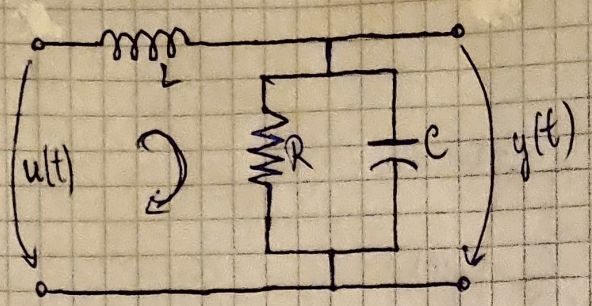
$$\lim_{\omega \to 0} \frac{\frac{R}{L} \cdot 0}{0 + 0 + \frac{1}{LC}} = 0 \; , \; \lim_{\omega \to \infty} \frac{\frac{R}{L} j\omega}{(j\omega)^2 + \frac{R}{L} \cdot j \cdot \omega + \frac{1}{LC}} = 0$$

$$\lim_{\omega \to \omega_{rez}} \frac{\frac{R}{L} j\omega_{rez}}{\left| (j\omega_{rez})^2 + \frac{R}{L} j\omega_{rez} + \frac{1}{LC} \right|} = \lim_{\omega \to \omega_{rez}} \frac{R}{L} j\omega_{rez} \cdot \frac{LC}{RCj\omega_{rez} + 1} = \frac{1}{Cj\omega_{rez}}$$

$\Rightarrow$ filtru trece banda

Conexiune paralel

①



Metoda impedanțelor: $H(j\omega) = \frac{Y(j\omega)}{U(j\omega)} = \frac{\frac{Z_R \cdot Z_C}{Z_R + Z_C}}{Z_L + \frac{Z_R \cdot Z_C}{Z_R + Z_C}} = \frac{Z_R \| Z_C}{Z_L + Z_R \| Z_C}$

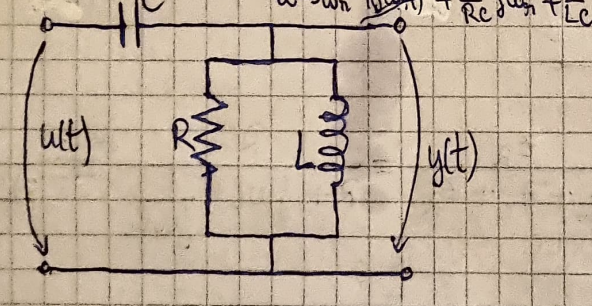
$$H(j\omega) = \frac{R \cdot \frac{1}{j\omega C}}{\frac{R + \frac{1}{j\omega C}}{j\omega L + \frac{R \cdot \frac{1}{j\omega C}}{R + \frac{1}{j\omega C}}}} \xrightarrow{j\omega \to s} H(s) = \frac{\frac{R \cdot \frac{1}{sC}}{R + \frac{1}{sC}}}{sL + \frac{R \cdot \frac{1}{sC}}{R + \frac{1}{sC}}} = \frac{\frac{R}{sC}}{\left(R + \frac{1}{sC}\right)\left(sL + \frac{R \cdot \frac{1}{sC}}{R + \frac{1}{sC}}\right)}$$

$$= \frac{R}{sC\left(R + \frac{1}{sC}\right)\left(sL + \frac{R \cdot \frac{1}{sC}}{R + \frac{1}{sC}}\right)} = \frac{R}{(sCR+1)\left(sL + \frac{R \cdot \frac{1}{sC}}{R + \frac{1}{sC}}\right)} = \frac{R}{s^2CRL + Ls + R} \quad | : CRL$$

$$H(s) = \frac{\frac{1}{LC}}{s^2 + \frac{1}{RC}s + \frac{1}{LC}} ; \lim_{\omega \to 0} \frac{\frac{1}{LC}}{0 + 0 + \frac{1}{LC}} = 1 ; \lim_{\omega \to \infty} \frac{\frac{1}{LC}}{\infty + \infty + \frac{1}{LC}} = 0$$

$$\lim_{\omega \to \omega_n} \frac{\frac{1}{LC}}{(j\omega_n)^2 + \frac{1}{RC} j\omega_n + \frac{1}{LC}} = \lim_{\omega \to \omega_n} \frac{1}{LC} \cdot \frac{RCL}{Lj\omega_n + R} = \frac{R}{R + Lj\omega_n}$$

②



Metoda impedanțelor: $H(j\omega) = \frac{Z_R \| Z_L}{Z_C + Z_R \| Z_L} = \frac{\frac{Z_R \cdot Z_L}{Z_R + Z_L}}{Z_C + \frac{Z_R \cdot Z_L}{Z_R + Z_L}}$

$$H(j\omega) = \frac{\frac{R \cdot j\omega L}{R + j\omega L}}{\frac{1}{j\omega C} + \frac{R \cdot j\omega L}{R + j\omega L}} \xrightarrow{j\omega \to s} H(s) = \frac{\frac{sRL}{R + sL}}{\frac{1}{sC} + \frac{sRL}{R + sL}} = \frac{sRL}{R + sL} \cdot \frac{sC(R + sL)}{s^2RLC + sL + R}$$

$$= \frac{s^2RLC}{s^2RLC + sL + R} \quad | RLC = \frac{s^2}{s^2 + \frac{1}{RC}s + \frac{1}{LC}}$$

$$\lim_{\omega \to 0} |H(j\omega)| = 0 ; \lim_{\omega \to \infty} |H(j\omega)| = 1$$

$$\lim_{\omega \to \omega_n} |H(j\omega)| = \lim_{\omega \to \omega_n} \frac{(j\omega_n)^2 \to 0}{(j\omega_n)^2 + \frac{1}{RC} j\omega_n + \frac{1}{LC}} = 0$$